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Video-Supplemented Task Training at the United States Steel Corp. Minntac Mine, Mt. Iron, MN

By D. T. Couillard, B. C. Nelson, and R. R. Tomassoni



UNITED STATES DEPARTMENT OF THE INTERIOR



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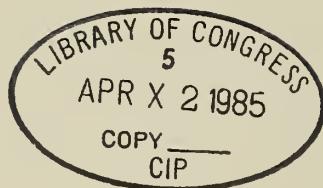
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CONTENTS

	<u>Page</u>
Abstract.....	1
Introduction.....	2
Convincing top management.....	3
Selecting and purchasing equipment.....	3
Production steps.....	5
Impact of video technology on training program.....	6
Additional video training applications.....	9
Summary.....	9

ILLUSTRATIONS

1. Safe job procedures (SJP) for use of bumping rail.....	2
2. Page from script of video SJP on proper use of bumping rail.....	5
3. Shooting video SJP on proper track tool use.....	6
4. Shooting preoperation checks of power shovel dipper on ore shovel.....	7
5. Recording final tape from raw footage.....	8
6. Adding graphics to final tape.....	8

TABLE

1. Equipment purchased for video-supplemented task training program.....	4
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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

h	hour	s	second
in	inch	V	volt
min	minute	yr	year

VIDEO-SUPPLEMENTED TASK TRAINING AT THE UNITED STATES STEEL CORP.
MINNTAC MINE, MT. IRON, MN

By D. T. Couillard,¹ B. C. Nelson,² and R. R. Tomassoni³

ABSTRACT

Video technology is becoming an important tool for many designers of industrial training programs. This report describes how trainers at the Minntac Mine, Mt. Iron, MN, have developed videocassettes of safe job procedures (SJP's) for training miners assigned to perform unfamiliar work tasks. All steps necessary for videocassette production, from idea to finished product, as well as the required equipment and prices, are listed and/or briefly explained. Minntac officials believe that the SJP videocassettes have contributed significantly to a reduction in mine accidents.

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INTRODUCTION

Task training is not a new idea at the United States Steel Corp. (U.S.S.). A companywide SJP program was initiated during Judge Gary's tenure as Chairman of the Board in the early 1900's. Over the years, the SJP has become the U.S.S. supervisor's standard reference for instructing employees on the job.

Three basic methods are used to develop SJPs:

1. A Job Safety Analysis (JSA) conference is held between the supervisor and employees experienced at performing the job. This is the preferred method because it involves everyone with an interest in the job and promotes employee commitment to the finished SJP.

2. The supervisor observes employees performing the job and writes the SJP based on what he observes.

3. The supervisor writes the SJP based on personal knowledge and past experience.

At U.S.S.'s Minnesota Ore Operations (Minntac pit, plant, and shops) in Mt. Iron, MN, approximately 10,000 SJP's have been developed for all major jobs. An example of an SJP is shown in figure 1. SJPs are filed in each department by occupation code and they are periodically reviewed and updated to reflect changes in equipment and/or technology. The supervisors use SJP's as their principal resource for training employees who are assigned new tasks. Company policy requires supervisors to review a minimum of four SJP's per month per each employee supervised and to conduct 15 to 20 brief safety contacts per employee per month as well. Records are kept of all SJP-related training to ensure accountability.

Date issued: Feb. 16, 1979

Code No. 611-4-i

Job: Use of bumping rail

Department: Mining

OPERATIONS (Steps)	PROTECTIVE APPAREL	PROCEDURES	HAZARDS (Safety contacts)
1. Make visual inspection of area.	Hard hat. Safety glasses and side shields. Recommend metatarsal safety shoes.	1. Make visual inspection of immediate area and check condition of bumper handles.	1. (a) Be aware of mobile equipment in area. (b) Remove slipping and tripping hazards if possible, including tools in area.
2. Bump rail.		2. (a) With four crewmembers handling bumper, face section to be bumped, and pick up bumper by handles. (b) On verbal signal from one crewmember, swing bumper back and then forward to strike light test blow on rail. (c) Continue striking rail with smooth, even, coordinated effort until stop signal is given from people at opposite end of section.	2. Avoid striking extremely hard blows or lunging at the rail.
3. Move bumper ahead.		3. (a) On verbal signal from one crewmember, lower bumper to ground. (b) All crewmembers face opposite direction, raise and carry bumper 8 ft beyond length of next section	

FIGURE 1. - Safe job procedure (SJP) for use of bumping rail.

The quality of SJP training at Minntac has largely been dependent upon the interpersonal and communication skills of the supervisors conducting the training. With a host of other duties to perform, many supervisors have tended to approach training mechanically, looking upon it as just another chore to finish as quickly as possible. Unfortunately, failure to follow established SJP's has been the direct cause of many accidents at Minntac, particularly in the pit. The possibility that this failure may have been related to inadequate SJP instruction has been a concern to Minntac officials responsible for developing new training programs and materials.

The program developers have sought to improve instructional quality by producing videocassettes of SJP's and making them accessible to the supervisors. Since the average age of the Minntac work force is under 30, most of the employes have grown up with television and have been "conditioned" to pay attention to it. Theoretically, seeing themselves at work on TV should make the employees even more attentive and receptive to the message being conveyed. To date, over 20 video SJP's have been completed. While efforts thus far have been concentrated primarily on pit jobs, videocassette production is foreseen for critical jobs in the plant and shop as well.

CONVINCING TOP MANAGEMENT

The idea to produce video SJP's originated from two supervisors who were involved with designing and conducting safety training programs for pit employees. Rising numbers of accidents in the mine had convinced them that traditional SJP training methods were not producing the desired results. Most of these accidents had been caused by human error: e.g., strains, sprains, hand injuries, slips, trips, and falls among members of the track gangs; and many of them probably would not have happened if the victims had been following established SJP's. The two supervisors believed that Minntac's TV-generation miners would be more likely to remember SJP's after seeing them performed on videocassettes. The employees would then apply this knowledge on the job by following correct procedures and hopefully experience fewer accidents.

While the idea seemed promising, it was also expensive. Top management was not likely to approve the purchase of video equipment without first being convinced that the benefits would justify the costs. The two training supervisors decided that the best way to sell the idea

was to produce a demonstration videocassette for presentation to key department heads. One of the supervisors, who had some previous experience and training in video technology, arranged to borrow equipment from a cooperative vendor in Duluth.

The resulting pilot production, titled "Safety Attitudes," began with a scene of a foreman unenthusiastically conducting a safety meeting to a group of obviously bored employees. It went on to show the foreman meeting with the same employees again, but this time he showed them a videocassette of a relevant SJP. Thus, the production was actually a "tape within a tape," attempting to show how foremen could use video SJP's to improve instruction, attitudes, and work performance.

"Safety Attitudes" was presented to all of the department heads at one meeting and was well received. As a result, the two training supervisors won management approval to purchase the required equipment. About 1 year passed from the time the two supervisors first thought of their idea to its final approval.

SELECTING AND PURCHASING EQUIPMENT

Despite the fact that permission to purchase equipment has been granted,

funds were limited. The program developers were therefore faced with the

problem of obtaining the minimum amount of equipment they would need to achieve an acceptable production quality at the lowest possible cost.

Because equipment prices, capabilities, and availability are constantly changing, selections were made primarily on the recommendations of the Duluth vendor. Table 1 lists the equipment purchased early in 1981 for the video-supplemented task training program. Costs are, of course, subject to change.

With the equipment listed in table 1, the Minntac training supervisors have

developed a no-frills, but serviceable video production capability. To improve production quality and efficiency, they would like to purchase an editing machine and a two-channel audio recorder. The editing machine would simplify the recording process and speed up production; and two-channel audio would promote greater realism, by allowing both background sounds and voice-overs to be recorded on the same videocassette. Cost constraints have thus far prevented these improvements. An editing machine alone is currently priced at approximately \$12,000.

TABLE 1 - Equipment purchased for video-supplemented training program

<u>Recording equipment</u>	<u>Cost</u>
Videocassette recorder; for 1/2-in cassettes; ac, dc, or battery operated; portable.....	\$1,060
Camera, color, portable (equipped with side viewfinder, which allows camera to be rested on operator's shoulder for steadier picture).....	935
Tripod for camera.....	134
Microphones:	
Unidirectional type, with desk stand, freestand, and boom.....	57
Tie-clip type.....	40
Video monitor (for field use), color, ac or dc, portable, 7 in.....	425
Miscellaneous extra batteries, cables, and adapters ¹	200
Videocassettes, 1/2 in:	
30 min.....	14 ea
60 min.....	16 ea

Classroom equipment

Videocassette player (playback unit only--no recording capability; note cost compared to that of video-cassette recorder).....	760
Video monitor: ²	
19 in.....	550
25 in.....	650
TV stand (must be high enough for good visibility and equipped with two shelves, for monitor and player).....	110

¹It is advisable to purchase adapters for the various voltages available in the mine: 12, 24, 110, 110, and/or 440 V.

²Size needed depends on class size and visibility. Monitors are not equipped with channel selectors and are therefore less attractive to thieves than regular TV sets.

PRODUCTION STEPS

The production process for SJP video-cassettes at U.S.S. is outlined below.

1. Select an SJP for videocassette development. Inputs from various supervisors, training personnel, safety engineers, and individual miners help the program developers to define problem areas and rank them according to priority. The departmental files of written SJP's provide further guidance. Another mitigating factor is technical feasibility; e.g., higher light levels in the pit permit better production quality than is possible in most plant areas.

2. Conduct a needs analysis. This step involves going to the work site and observing people performing the job, and questioning both the supervisors and employees about specific problems and desires. This process results in a clearer understanding of what the job is really like, what the training requirements are, and what might be done to anticipate and solve potential technical problems before beginning production.

3. Review the SJP. If the written procedure has become outdated or if none exists, the program developers will assist the foreman in writing a new SJP.

4. Develop a script. A worksheet is used to sketch scenes, write narration, and estimate the time required for both video and audio segments (fig. 2). Scripts usually take 2 to 3 h to complete.

5. Arrange a shooting date, time, and place with the appropriate supervisor. Advanced planning is essential to ensure that videotaping time is used productively.

6. Shoot the raw footage (figs. 3-4). Typically, 2-1/2 h of raw footage will be shot to produce a 17-min videocassette

7. Record the final tape. At the "studio," the raw tape is played on the playback unit and reviewed. The video

recorder is then used to record the desired parts of raw footage onto a final tape (fig. 5). Graphics are also added at this point (fig. 6). Title slides, charts, and other art works are prepared either during the scriptwriting stage or at the time of final editing. At Minntac, graphics are created by "local talent": A training supervisor might ask a group of employees, "Do you know anyone here who can draw?", and quite often someone can. Recognizing employee talents as an important human resource, Minntac records such information on its computer along with other personnel data. The finishing touch to the video SJP is the recording of additional audio, which is basically the narration and sometimes music.

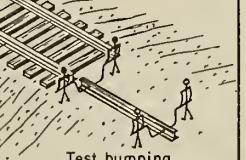
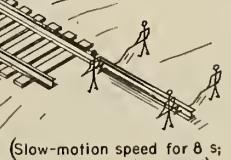
VIDEO	AUDIO
11 s 	When using the bumper, check out the tool. Check the handles for tightness and general condition. Check rail for cracks, chips, and mushrooming on the face.
17 s  Four employees picking up rail	When lifting the bumping rail, all four members should face the bumper and pick up the handles on a verbal command from one crewmember. The bumper rail should be picked up together using the proper lifting procedure. Coordination of all crew members is a must on this job
13 s  Test bumping	The two crewmembers with the best aim should be on the front. Again one crew member should give a verbal signal to coordinate the swinging of the rail. Two light test blows should be given to ensure coordination.
14 s  (Slow-motion speed for 8 s; resume regular speed)	As you can see in slow motion, smooth, even coordinated strokes should be used. Avoid striking extremely hard blows or lunging at the rail. Continue to strike the rail until the stop signal is given.

FIGURE 2. - Page from script of video SJP on proper use of bumping rail.

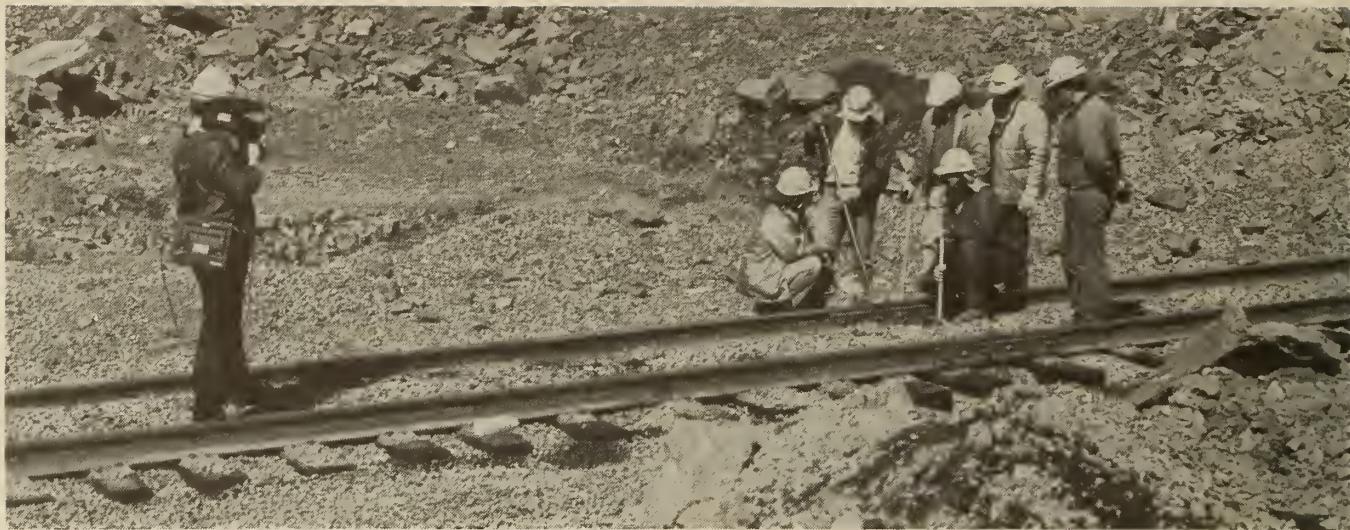


FIGURE 3. - Shooting video SJP on proper track tool use.

IMPACT OF VIDEO TECHNOLOGY ON TRAINING PROGRAM

Video SJP's have become extremely popular with both employees and supervisors since their introduction in July of 1981. As expected, attentiveness at training sessions has improved. The hypothesis that employees would respond favorably in seeing themselves on TV has proven to be a correct one. Encouraged by positive employee feedback, many supervisors have actually begun to enjoy conducting meetings.

The biggest problem now faced by the program developers is to satisfy the demand for video SJP's. With only two people available for video production, fulfilling the requests for foremen from the pit, plant, and shops is a slow process. An editing machine would help to speed up this process, but as already mentioned, editing machines are expensive. Before approving such a large purchase, management would once again have to be convinced that the potential benefits would justify the cost.

Even with the present production methods, a number of significant benefits have already been achieved. For example, there have been several indications that TV training has helped to improve retention of the information presented. After seeing a videocassette explaining the

proper use of five types of respirators, shop employees began to ask for this "new" protection, even though each respirator shown had been available to them for a number of years. Many supervisors responded to the same tape by enforcing respirator use more conscientiously than they had before.

Another benefit has been a substantial reduction in accidents, which result in both lost time and diminished work capacity among pit employees. Pit supervisors are convinced that video-supplemented SJP training has been the most important factor contributing to this reduction.

Pit supervisors also believe that miners have become more productive as a result of the video training. For example, even though recent personnel cutbacks have caused a number of people lacking pit experience to "bump" into pit jobs, pit accidents have continued to decline. Fewer accidents have led to less downtime and equipment damage and lower maintenance costs. Certainly untypical for inexperienced employees, these results have been directly related to the video-assisted SJP training the transferees received when they began working in the pit.



FIGURE 4. - Shooting preoperation checks of power shovel dipper on ore shovel.



FIGURE 5. - Recording final tape from raw footage.



FIGURE 6. - Adding graphics to final tape.

ADDITIONAL VIDEO TRAINING APPLICATIONS

The Minntac program developers have begun to apply video technology in areas other than task training. Following are three examples:

1. A videocassette explaining standard company blasting procedures has been shown to community groups to improve public relations; it has also been shown to employees not directly involved with blasting during new miner and annual refresher classes.

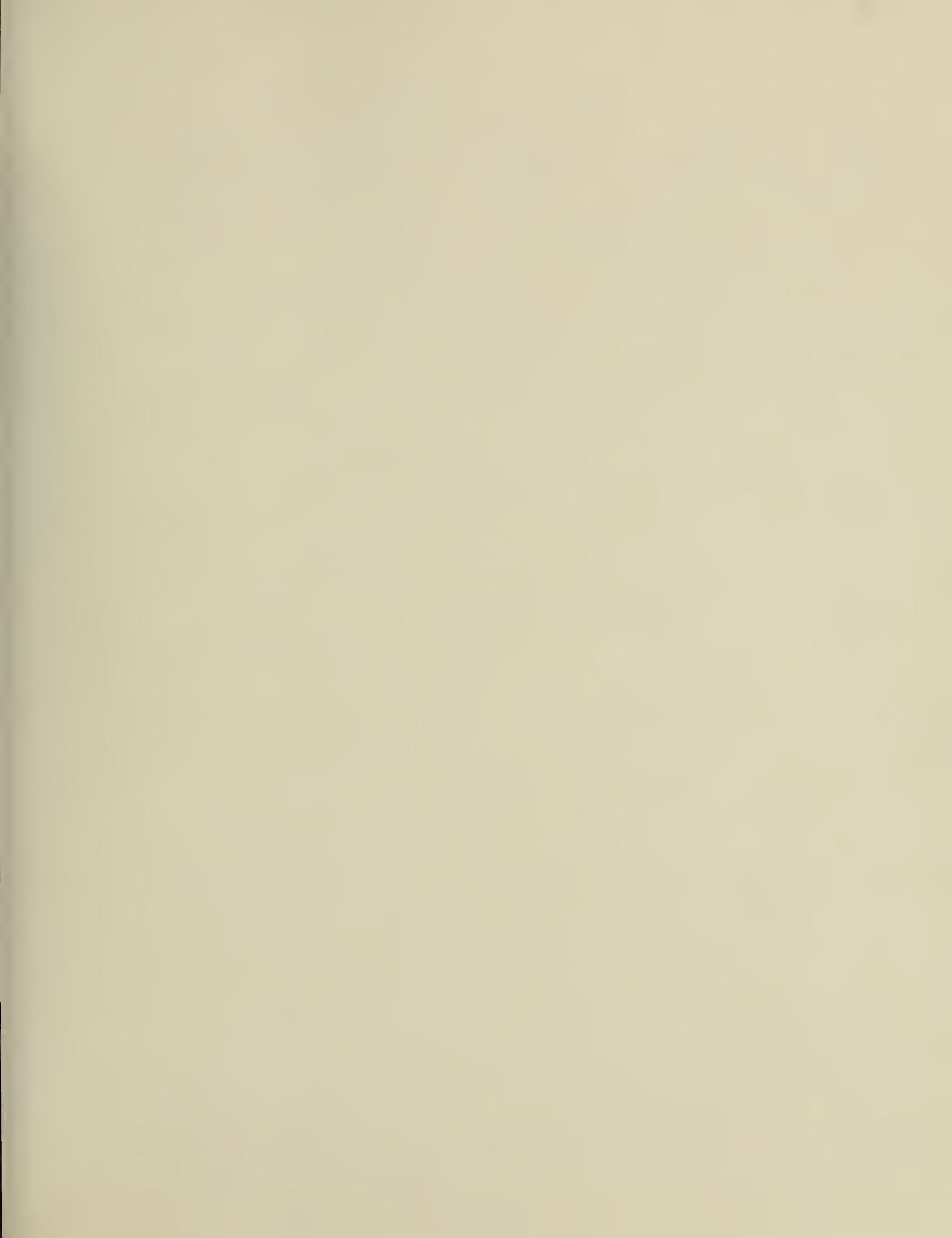
2. Videocassettes of accident scenes have been produced to provide objective records of accidents. They are later shown to supervisors to improve accident-investigation skills and to employees to promote accident prevention.

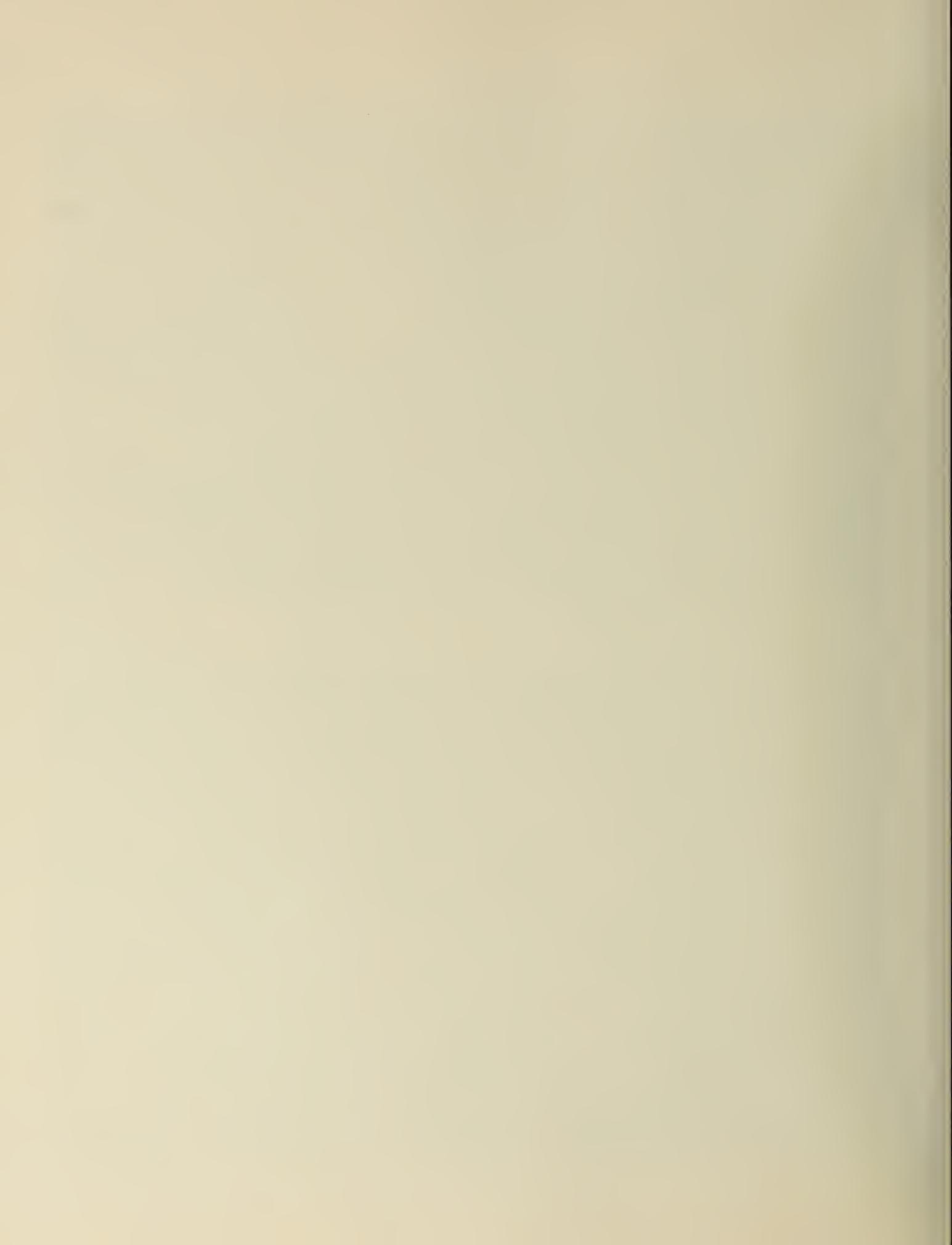
3. Supervisors have had the opportunity to critique their own instructional skills by seeing videocassettes of themselves conducting minicourses and safety meetings during company-sponsored "Train the Trainer" and supervision courses.

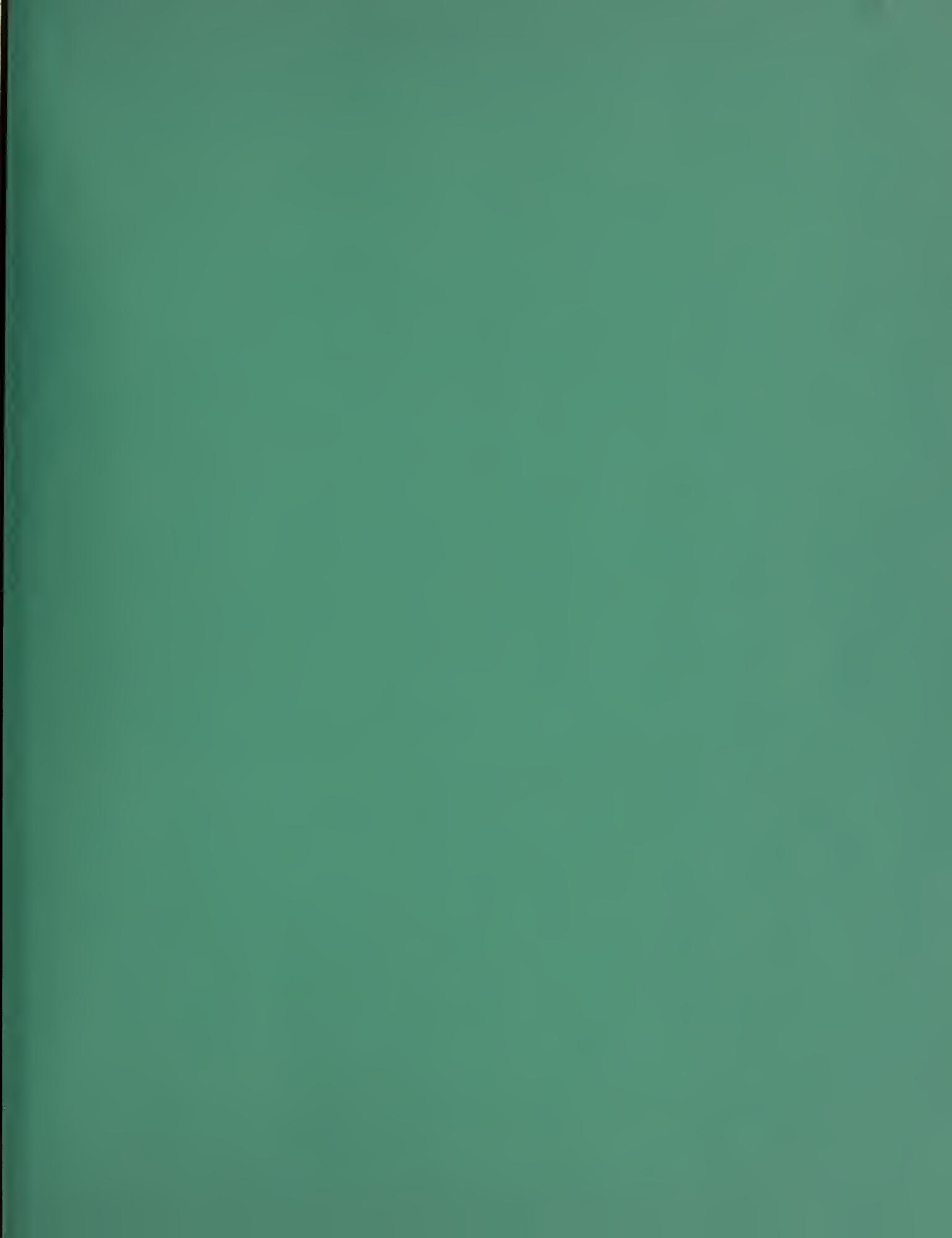
SUMMARY

The Minntac experience has demonstrated that video technology can be used to dramatically improve the effectiveness of task training at a reasonable cost. Increased attentiveness and enthusiasm from

both trainees and trainers, better retention of information, and fewer accidents have all occurred since the introduction of video SJP's.







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